



Aalto University
School of Science

CS-E4660 Advanced Topics in Software Systems

Hands-on tutorial: Machine Learning pipeline on Edge

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Who I am? and what is this tutorial about?

■ Who I am?

- I am Minh Tri Nguyen
- MSc degree in Computer Science in 2019
- PhD student at Aalto University

■ What is this tutorial about

- Machine Learning inference on edge devices.
- A quick demo of deploying a simple ML pipeline on Raspberry Pi.

Overview

■ Why do we need to move ML to the edge

- Mitigating computing and network function burdens on the cloud as cloud resources are costly.
- Edge devices are located close to user application/IoT devices/data sources, which is necessary for supporting real-time services.
- ...

■ Difficulties:

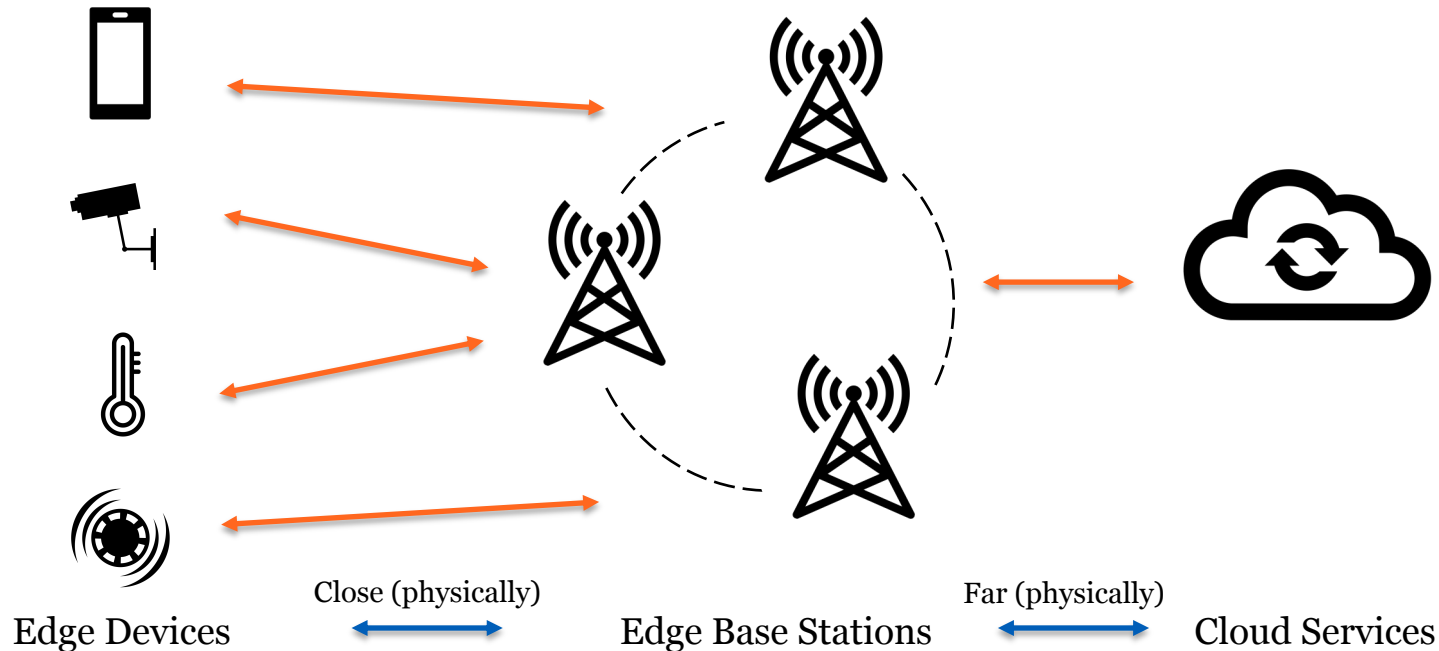
- Limited computing resources – CPU, memory, storage, accelerator, energy/power..
- Network problems - unstable/reliable connectivity, low-bandwidth.
- Low-level of supporting application development
- Heterogeneous hardware
- ...

System Outline

- **IoT streaming data pipeline**
 - Sensor/Edge devices collecting data (e.g., environment monitoring data, video, image, ...)
 - IoT Data Hub (MQTT broker, ...)
 - Data ingestion service
- **Machine Learning pipeline**
 - Data ingestion, pre-processing, ...
 - Model design, training, optimization
 - ML serving/inference (on the Edge)

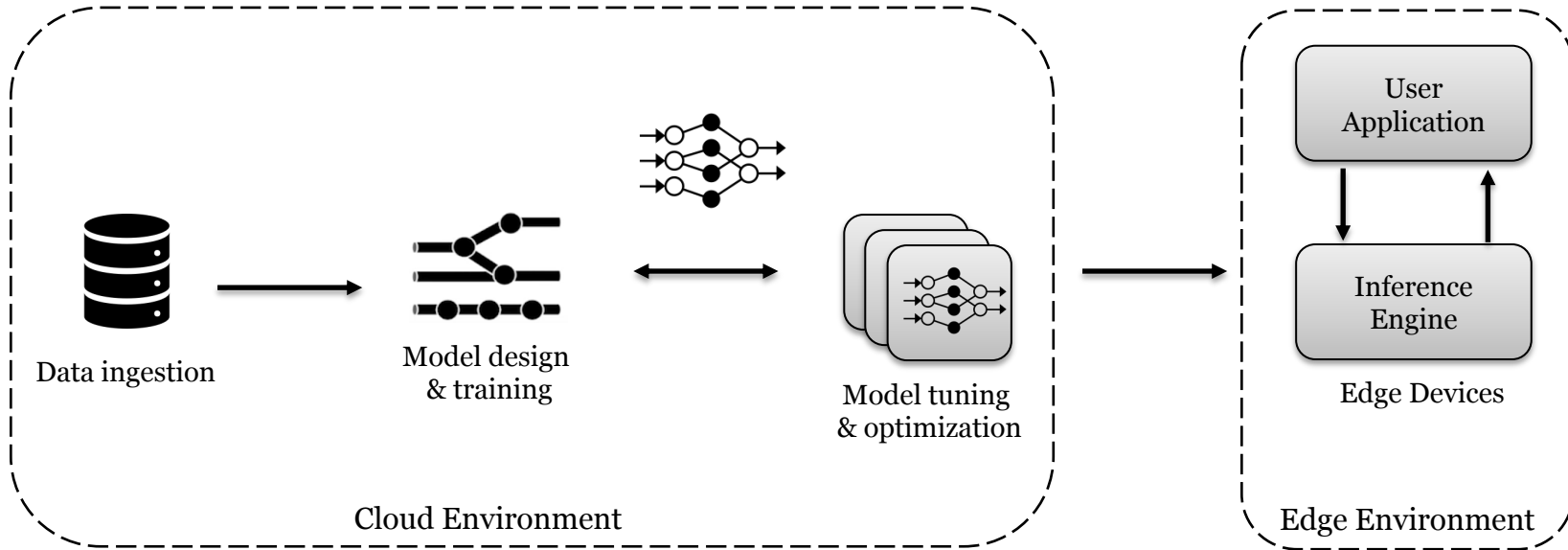
System Outline

- IoT streaming data pipeline
 - Implemented using MQTT: publisher, subscriber, ...



System Outline

- Machine Learning pipeline

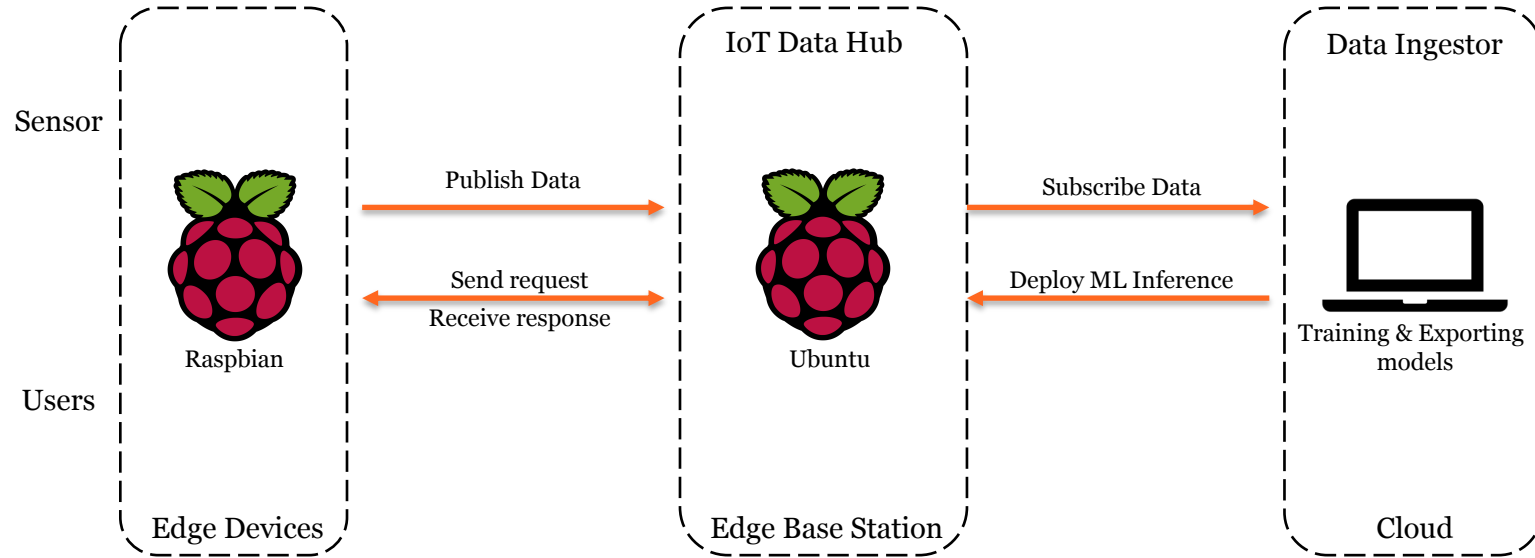


A Quick Guide for ML pipeline on Edge

- **Prerequisite**

- Python 3 virtual environment
- TensorFlow 2.3.0
- TensorFlow Lite
- Numpy
- Java environment (JRE 11)
- Pandas
- Paho MQTT

A Quick Guide for ML pipeline on Edge



Discussion

Contact and Further information

- <https://version.aalto.fi/gitlab/sys4bigml/cs-e4660>
- https://docs.openvinotoolkit.org/2020.4/openvino_docs_MO_DG_Deep_Learning_Model_Optimizer_DevGuide.html

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